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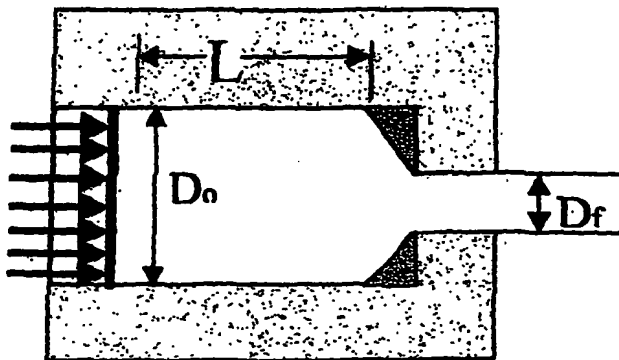
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(54) Title: MOLYBDENUM ALLOY X-RAY TARGETS HAVING UNIFORM GRAIN STRUCTURE



(57) Abstract: The invention relates to a process for making a cross-directionally worked molybdenum plate, the process comprising: (a) reducing ammonium molybdate and forming molybdenum metal powder; (b) consolidating a molybdenum component comprised of molybdenum metal powder and an alloying element to a first workpiece, the alloying element being selected from the group consisting of titanium, zirconium, hafnium, carbon, lanthanum oxide, and combinations thereof; (c) thermally treating the first workpiece and subjecting the workpiece to thermo-mechanical forces in a first direction, and thereby forming a second workpiece; (d) thermally treating the second workpiece and subjecting the second workpiece to thermo-mechanical forces in a second direction that is different from the first direction; (e) subjecting

the thermomechanically treated second workpiece to a recrystallization heat treatment step, and thereby forming a heat-treated cross-directionally worked workpiece; and (f) subjecting the heat-treated, cross-directionally worked workpiece to a slicing step or a machining step, and thereby forming the crossdirectionally worked molybdenum plate. The invention also relates to X-ray targets made from the process.

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/04/011554

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B22F3/16 H01J35/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B22F H01J C22C C22F C23C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 077 811 A (BURMAN RUSSELL W) 7 March 1978 (1978-03-07) column 1, line 15 - line 25 column 1, line 53 - column 2, line 14 column 2, line 26 - line 30 column 2, line 42 - column 3, line 4 claims; examples 1,2 ----- -/--	1,3-7, 13-17

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 04/011554

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 02/070765 A (KUMAR PRABHAT ; JEPSON PETER R (US); STARCK H C INC (US); UHLENHUT HEN) 12 September 2002 (2002-09-12)	1-10, 13-18
A	abstract page 1, paragraph 2 page 5, paragraph 15 - paragraph 16 page 7, paragraph 26 - page 8, paragraph 29 page 11, paragraph 39 - page 12, paragraph 42 claims 1,8,9,11-13,19,23,24; figures	19-22
X	US 5 868 876 A (BIANCO ROBERT ET AL) 9 February 1999 (1999-02-09)	19
Y	abstract column 1, line 14 - column 2, line 4 column 2, line 27 - column 3, line 15 column 3, line 49 - column 4, line 60 claims; figures	1-10, 13-18
Y	GB 938 546 A (DU PONT) 2 October 1963 (1963-10-02) page 1, line 11 - line 22 page 2, line 1 - line 41 page 3, line 8 page 4, line 62 - line 78 page 5, line 84 - line 104 page 6, line 25 - line 83 page 7, line 113 - page 8, line 9 claims; figures; example 18	1-10, 13-18
X	US 2001/001401 A1 (SEGAL VLADIMIR) 24 May 2001 (2001-05-24)	1-10, 13-16
A	paragraph '0001! paragraph '0014! paragraph '0025! - paragraph '0026! paragraph '0031! - paragraph '0038! paragraph '0041! paragraph '0052! - paragraph '0059! claim 1; figures	19-22
X	US 2003/052000 A1 (FERRASSE STEPHANE ET AL) 20 March 2003 (2003-03-20)	1-7, 13-17
A	abstract figures paragraph '0001! paragraph '0004! - paragraph '0012! paragraph '0038! paragraph '0043! - paragraph '0044! paragraph '0047! - paragraph '0069! paragraph '0090! - paragraph '0091! paragraph '0097! - paragraph '0099! claims	19-22

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 04/011554

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2001/036249 A1 (BENZ MARK GILBERT ET AL) 1 November 2001 (2001-11-01) the whole document	1-22
A	EP 0 055 828 A (GEN ELECTRIC) 14 July 1982 (1982-07-14) the whole document	1-22
A	US 2001/014568 A1 (ITOH MASAYUKI ET AL) 16 August 2001 (2001-08-16) the whole document	19, 21
P, X	US 6 707 883 B1 (BALASUBRAMANIAN SRIHARI ET AL) 16 March 2004 (2004-03-16)	19-22
A	abstract column 1, line 7 - line 11 column 2, line 16 - line 52 column 3, line 15 - column 4, line 39 column 5, line 10 - column 6, line 8 claims; figures	1-18
P, A	WO 2004/022801 A (OSRAM SYLVANIA INC ; WINNICKA MARIA B (US)) 18 March 2004 (2004-03-18) the whole document	1-18

INTERNATIONAL SEARCH REPORT

International application No.
US2004/011554

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

Continuation of Box II.2

Claims Nos.: -

Present claims 17 and 19 to 22 relate to a method or product, respectively, defined (inter alia) by reference to the following parameter:

"radial" strength

The use of this parameters in the present context is considered to lead to a lack of clarity within the meaning of Article 6 PCT. It is impossible to compare the parameter the applicant has chosen to employ with what is set out in the prior art. The lack of clarity is such as to render a meaningful complete search impossible. Consequently, the search has been restricted to : molybdenum components having high-strength and creep-resistance at elevated temperatures.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 04/011554

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